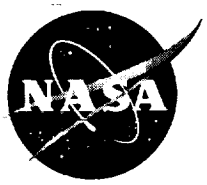
NASA/TM—2000–209891, Vol. 35



Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and David E. Knapp, Editors

Volume 35

BOREAS HYD-8 1996 Gravimetric Moss Moisture Data

R. Fernandes

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

July 2000

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BOREAS HYD-8 1996 Gravimetric Moss Moisture Data

Richard Fernandes

Summary

The BOREAS HYD-8 team made measurements of surface hydrological processes that were collected at the SSA-OBS Tower Flux site in 1996 to support its research into point hydrological processes and the spatial variation of these processes. Data collected may be useful in characterizing canopy interception, drip, throughfall, moss interception, drainage, evaporation, and capacity during the growing season at daily temporal resolution. This particular data set contains the gravimetric moss moisture measurements from July to August 1996. To collect these data, a nested spatial sampling plan was implemented to support research into spatial variations of the measured hydrological processes and ultimately the impact of these variations on modeled carbon and water budgets. These data are stored in ASCII text files.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS HYD-08 1996 Gravimetric Moss Moisture Data

1.2 Data Set Introduction

This particular data set contains the gravimetric moss moisture measurements made at the BOReal Ecosystem-Atmosphere Study (BOREAS) Southern Study Area (SSA) Old Black Spruce (OBS) site from July to August 1996. To collect these data, a nested spatial sampling plan was implemented to support research into spatial variations of the measured hydrological processes and ultimately the impact of these variations on modeled carbon and water budgets. These data are stored in American Standard Code for Information Interchange (ASCII) text files.

1.3 Objective/Purpose

The objective of the data set was to quantify the magnitude and spatial variation of storages and fluxes at the moss surface and during precipitation events in a selected Picea Mariana stand. The following parameters were measured to permit future parameterization of flux models: throughfall, stemflow, moss water storage, and gross precipitation. A nested spatial sampling plan was implemented to characterize the length scales of variations of the measured parameters for future use in modeling studies and for comparison with measurements at the flux tower located at the SSA-OBS study site.

1.4 Summary of Parameters

Turf Lysimeter Dry Weights Turf Lysimeter Water Equivalent Depths (daily and after storm events) (mm H_2O)

1.5 Discussion

Hydrological processes such as canopy evaporation, moss storage, and moss evaporation may play a significant role in controlling water fluxes during the growing season in boreal wetlands. Canopy interception, moss storage, and moss evaporation were measured using mass balance methods (throughfall catch buckets and lysimeters) to give a quantitative estimate of these processes for sparse black spruce stands. More importantly, the spatial sampling scheme allowed quantification of the expected variation of these processes within the footprint of a colocated flux measurement tower. This will allow consideration of the subtower-footprint controls on vapor fluxes that the tower is measuring. In addition, the data set will be useful in parameterizing flux models for the site targeted as well as determining the typical variation in fine scale processes that the models may have to account for when scaling to watershed and regional extents.

1.6 Related Data Sets

BOREAS HYD-08 Throughfall Data
BOREAS HYD-08 1994 Gravimetric Moss Moisture Data
BOREAS HYD-08 Gross Precipitation Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

Dr. Lawrence Band
University of North Carolina
Chapel Hill, NC

Formerly at:
University of Toronto
Department of Geography
Toronto, Ontario

2.2 Title of Investigation

Simulation of Boreal Ecosystem Carbon and Water Budgets: Scaling from Local to Regional Extents

2.3 Contact Information

Contact 1:
Richard Fernandes
University of Toronto
Department of Geography
Toronto, Ontario
Canada
(416) 978-5070
(416) 978-6729 (fax)
fernande@geog.utoronto.ca

Contact 2:
Dr. Lawrence Band
University of Toronto
Department of Geography
Toronto, Ontario
Canada
(416) 978-3375
(416) 978-6729 (fax)
lband@geog.utoronto.ca

Contact 3:
David Knapp
Raytheon ITSS
NASA GSFC
Code 923
Greenbelt, MD 20771
(301) 286-1424
(301) 286-0239 (fax)
David.Knapp@gsfc.nasa.gov

3. Theory of Measurements

Turf Lysimeters

Turfs were located randomly; however, some turfs were relocated because of the presence of live roots. Turfs 15 cm x 15 cm square were extracted by hand to the bottom of the live moss layer (defined by the presence of a horizontal litter mat for Pleurozium schreberi. and by the end of thalli for Sphagnum spp.). The turfs were placed on a mesh tray and then replaced in the pit from which they were extracted. Turfs were weighed daily and after rain events by placing them directly on a leveled electronic scale. If turfs were over field capacity (water dripped from them), the phenomenon was noted, and weighing proceeded after the majority of drip water had ceased. Any large litter components that appeared on turfs during the measurement period were removed and placed on the moss surface beside the turf. Turf water equivalent depth was computed by later oven drying the turfs and determining dry turf + lysimeter tray weights to compute water weight, assuming a constant 1,000 kg/m^3 density of H_2O to compute water equivalent depth.

4. Equipment

4.1 Sensor/Instrument Description

Turf Lysimeter Mesh Base

A 15-cm x 15-cm aluminum mesh tray with 10-gauge wire mesh and 1-cm mesh holes was used as the base of each lysimeter. Monofilament fishing line was used to form handles to extract the lysimeter from the turf pit.

Electronic Weigh Scales

An electronic balance was used for weighing quantities with weights less than 1 kg. A different balance was used for weighing quantities above 1 kg. Both balances were tared before and after weighing and had been calibrated immediately before the field campaign and at the University of Toronto after the measurement campaign. The balances had an auto-off condition where taring was not possible or when battery power was low.

4.1.1 Collection Environment

These measurements were made in a spruce forest, near the SSA-OBS tower site, where moss covered the ground.

4.1.2 Source/Platform

Turf Lysimeters - Placed in pits from which turfs were extracted.

4.1.3 Source/Platform Mission Objectives

The objective was to measure daily changes in water storages or turf weights.

4.1.4 Key Variables

Turf Lysimeter - Turf weight, turf water equivalent depth.

4.1.5 Principles of Operation

All of the equipment depended on holding a quantity of H_2O and turf that was then weighed. The weight of the water was determined by subtracting the oven-dried weight of each turf from the weights that were measured in the field under wet conditions. The weight of the water can then be converted to a water equivalent depth based on the size of the gauge (15 cm by 15 cm).

4.1.6 Sensor/Instrument Measurement Geometry

All throughfall and catch gauges were repositioned using a bubble level to ensure that they were upright. The turf lysimeters were extracted vertically from the pits even for pits on the sides of hummocks.

4.1.7 Manufacturer of Sensor/Instrument

Gauges and Lysimeters - Darryl Carlysle Moses and Kira Dunham
(University of Toronto, Dept. of Geography)

Weigh Scales - (2) MARS MS3000W Series

4.2 Calibration

The weigh scales were calibrated to within the manufacturer's specifications immediately before the measurement campaign and at the University of Toronto after the campaign. The effect of the weigh scales being off level was also tested with no appreciable difference for tilt angles less than 20 degrees (which were defined by the first indent in the bubble level gauge used in the field).

4.2.1 Specifications

None given.

4.2.1.1 Tolerance
None given.

4.2.2 Frequency of Calibration
The weigh scales were calibrated to within the manufacturer's specifications immediately before the measurement campaign and at the University of Toronto after the campaign.

4.2.3 Other Calibration Information
None.

5. Data Acquisition Methods

Each gauge and lysimeter was placed at a randomly selected location in each stratified plot or in clearings in the case of throughfall gauges. The locations were not changed during the field campaign. Measurements were made at each plot for all gauges and lysimeters before moving to another plot.

6. Observations

6.1 Data Notes
None given.

6.2 Field Notes
None given.

7. Data Description

7.1 Spatial Characteristics
All measurement plots were located within 500 m of the SSA-OBS flux tower along a single transect leading radially outwards from the tower. The goal was to place the plots on a perceived wetness gradient while keeping them within the flux tower footprint. In addition, each plot was located so it was separated from the others to characterize the typical spatial variability of surface hydrological processes. Unfortunately, no plot was located in a region dominated by Sphagnum bogs, so turf lysimeters with sphagnum were located in isolated sphagnum patches within 10 m of each plot.

7.1.1 Spatial Coverage
Seven plots were located along a transect in the vicinity of the SSA-OBS flux tower. Each plot had five live turf lysimeters (identified as gauges L1 through L5) and five throughfall gauges (in a separate data set), one throughfall gauge near each live turf lysimeter, three live + fermentation layer turf lysimeters (identified as gauges LF1 through LF3), and one nearby sphagnum turf lysimeter (identified as gauge SP1). In addition, two throughfall plots with over 20 throughfall gauges were located independently (in a separate data set). The location of the flux tower was determined by Global Positioning System (GPS) and is at the following North American Datum of 1983 (NAD83) coordinates:

Site	Longitude	Latitude	BOREAS Grid X	BOREAS Grid Y
SSA-OBS (Flux Twr.)	105.11779W	53.98717N	385.012	348.646

7.1.2 Spatial Coverage Map
None given.

7.1.3 Spatial Resolution

The resolution of the measurement varies with the type of measurement. Turf lysimeters measure weights for the extent of the turf (15 cm x 15 cm surface, approximately 15 cm deep). However, the throughfall gauges may catch precipitation from a region larger than their orifices. The "fetch" of a throughfall or rain gauge depends on windspeed, precipitation intensity, and the cover over the gauge.

7.1.4 Projection

Measurement locations within sites are represented on sketches with no projection.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

The data were collected from July to August 1996 with some small gaps.

7.2.2 Temporal Coverage Map

None.

7.2.3 Temporal Resolution

Data were collected daily and after each rain event where possible. The time of day of data collection is indicated in the data record. However, it typically took 1.5 hours to complete data collection of all sites.

7.3 Data Characteristics

7.3.1 Parameter/Variable

The parameters contained in the data files on the CD-ROM are:

HYD08_MOSS_GRAV_96

Column Name
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
PLOT_ID
GAUGE_ID
WATER_EQUIVALENT
CRTFCN_CODE
REVISION_DATE

HYD08_MOSS_DRY_WTS_96

Column Name
SITE_NAME
SUB_SITE
DATE_OBS
PLOT_ID
GAUGE_ID
WEIGHT
CRTFCN_CODE
REVISION_DATE

7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the data files on the CD-ROM are:

HYD08_MOSS_GRAV_96

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were collected.
PLOT_ID	The identifier for the plot from which the measurement came.
GAUGE_ID	The identifier for the gauge from which the measurement came.

This information regarding GAUGE_ID can be decoded with the following information. The first one or two characters indicate(s) the layer(s) of moss, or if the gauge was in sphagnum moss.

L : The litter layer is included.
F : The fibric layer is included.
SP: Indicates that the gauge was in sphagnum moss.
: A number indicating the number of the turf.

WATER_EQUIVALENT	The water equivalent depth.
CRTFCN_CODE	The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

HYD08_MOSS_DRY_WTS_96

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIIII, where GGGGG is

	the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
PLOT_ID	The identifier for the plot from which the measurement came.
GAUGE_ID	The identifier for the gauge from which the measurement came.

This information regarding GAUGE_ID can be decoded with the following information. The first one or two characters indicate(s) the layer(s) of moss
or if the gauge was in sphagnum moss.

L : The litter layer
F : The fibric layer
SP: Indicates that the gauge was in sphagnum moss.
: A number indicating the number of the turf.

WEIGHT	The weight of the sample (including tray).
CRTFCN_CODE	The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

7.3.3 Unit of Measurement

The measurement units for the parameters contained in the data files on the CD-ROM are:

HYD08_MOSS_GRAV_96

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
PLOT_ID	[none]
GAUGE_ID	[none]
WATER_EQUIVALENT	[millimeters]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

HYD08_MOSS_DRY_WTS_96

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
PLOT_ID	[none]
GAUGE_ID	[none]
WEIGHT	[grams]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

7.3.4 Data Source

The sources of the parameter values contained in the data files on the CD-ROM are:

HYD08_MOSS_GRAV_96

Column Name	Data Source
SITE_NAME	[Assigned by BORIS]
SUB_SITE	[Assigned by BORIS]
DATE_OBS	[Supplied by Investigator]
TIME_OBS	[Supplied by Investigator]
PLOT_ID	[Supplied by Investigator]
GAUGE_ID	[Supplied by Investigator]
WATER_EQUIVALENT	[Supplied by Investigator]
CRTFCN_CODE	[Assigned by BORIS]
REVISION_DATE	[Assigned by BORIS]

HYD08_MOSS_DRY_WTS_96

Column Name	Data Source
SITE_NAME	[Assigned by BORIS]
SUB_SITE	[Assigned by BORIS]
DATE_OBS	[Supplied by Investigator]
PLOT_ID	[Supplied by Investigator]
GAUGE_ID	[Supplied by Investigator]
WEIGHT	[Supplied by Investigator]
CRTFCN_CODE	[Assigned by BORIS]
REVISION_DATE	[Assigned by BORIS]

7.3.5 Data Range

The following table gives information about the parameter values found in the data files on the CD-ROM.

HYD08_MOSS_GRAV_96

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SITE_NAME	SSA-OBS-FLXTR	SSA-OBS-FLXTR	None	None	None	None
SUB_SITE	HYD08-MOS01	HYD08-MOS01	None	None	None	None
DATE_OBS	04-JUL-96	11-AUG-96	None	None	None	None
TIME_OBS	0	2330	None	None	None	None
PLOT_ID	A	G	None	None	None	None
GAUGE_ID	L1	SP1	None	None	None	None
WATER_EQUIVALENT	.2	60.7	None	None	None	Blank
CRTFCN_CODE	PRE	PRE	None	None	None	None
REVISION_DATE	03-APR-98	03-APR-98	None	None	None	None

HYD08_MOSS_DRY_WTS_96

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SITE_NAME	SSA-OBS-FLXTR	SSA-OBS-FLXTR	None	None	None	None
SUB_SITE	HYD08-MDW01	HYD08-MDW01	None	None	None	None
DATE_OBS	13-AUG-96	13-AUG-96	None	None	None	None
PLOT_ID	A	G	None	None	None	None
GAUGE_ID	L1	SP1	None	None	None	None
WEIGHT	55.4	274.8	None	None	None	None
CRTFCN_CODE	PRE	PRE	None	None	None	None
REVISION_DATE	21-MAY-97	21-MAY-97	None	None	None	None

Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value -- The value that indicates missing data. This is used to indicate that an attempt was made to determine the parameter value, but the attempt was unsuccessful.
Unrel Data Value -- The value that indicates unreliable data. This is used to indicate an attempt was made to determine the parameter value, but the value was deemed to be unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the instruments detection limits. This is used to indicate that an attempt was made to determine the parameter value, but the analysis personnel determined that the parameter value was below the detection limit of the instrumentation.
Data Not Cllctd -- This value indicates that no attempt was made to determine the parameter value. This usually indicates that BORIS combined several similar but not identical data sets into the same data base table but this particular science team did not measure that parameter.

Blank -- Indicates that blank spaces are used to denote that type of value.
N/A -- Indicates that the value is not applicable to the respective column.
None -- Indicates that no values of that sort were found in the column.

7.4 Sample Data Record

The following are wrapped versions of data records from a sample data file on the CD-ROM.

HYD08_MOSS_GRAV_96

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,PLOT_ID,GAUGE_ID,WATER_EQUIVALENT,
CRTFCN_CODE,REVISION_DATE
'SSA-OBS-FLXTR','HYD08-MOS01',04-JUL-96,2030,'A','L1',7.7,'PRE',03-APR-98
'SSA-OBS-FLXTR','HYD08-MOS01',04-JUL-96,2030,'A','L2',2.9,'PRE',03-APR-98
```

```
HYD08_MOSS_DRY_WTS_96

SITE_NAME,SUB_SITE,DATE_OBS,PLOT_ID,GAUGE_ID,WEIGHT,CRTFCN_CODE,REVISION_DATE
'SSA-OBS-FLXTR','HYD08-MDW01',13-AUG-96,'A','LF1',143.0,'PRE',21-MAY-97
'SSA-OBS-FLXTR','HYD08-MDW01',13-AUG-96,'A','LF2',183.0,'PRE',21-MAY-97
```

8. Data Organization

8.1 Data Granularity

The smallest amount of data that can be ordered from this data set is a day's worth of data.

8.2 Data Format(s)

The Compact Disk-Read-Only Memory (CD-ROM) files contain American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

9. Data Manipulations

9.1 Formulae

See Section 9.1.1.

9.1.1 Derivation Techniques and Algorithms

The mass of water in a lysimeter was estimated as:

mass_water(g) = wet_mass(g) - dry_mass(g) - tray_mass(g)

The computation of water equivalent depth for the lysimeters was performed using:

d (mm) = 1000 (mm/m) * mass_water(g) / (1000 kg/m^3 * area_gauge_bottom(m^2))

9.2 Data Processing Sequence

9.2.1 Processing Steps

- Set up necessary equipment.
- Performed daily weighings and emptied weighed gauges.
- Performed the necessary data manipulations and computed water equivalent depth.
- Added the necessary column headings.
- Transferred the information to the BOREAS Information System (BORIS).
- Loaded the data into the relational data base (done by BORIS staff).

9.2.2 Processing Changes

None.

9.3 Calculations

See Section 9.1.1.

9.3.1 Special Corrections/Adjustments
None.

9.3.2 Calculated Variables
None.

9.4 Graphs and Plots
None.

10. Errors

10.1 Sources of Error

Quantifiable Errors

- Location errors - The plots were located with reference to the flux tower using dead reckoning. Errors on the order of ± 10 m can be expected for the location of plot origins and ± 0.1 m for the location of measurement sites within plots.
- Dimensional measurements - Measurements of radii and length and width dimensions were made using a metric hand ruler. An error of ±0.5 mm in precision is possible. This will result in negligible errors in computed surface areas of catch gauges or turf trays.
- Area of moss turfs - While the turf tray area was measured accurately and with high precision, the actual turf did not always have the same area as the tray because of a sloping surface or bulging sides. This may result in a difference in actual area of ±5% of the computed area.
- Throughfall gauge weighing error - Tests were performed to detect the weight of water drops present on sides of throughfall gauges. These weights were not measurable. The average weight of all throughfall gauges was used to compute the net weight of water in the gauge. The error in using the average weight is less than +/-0.1 g and can be considered negligible.
- Weigh scale errors - The weigh scale errors assuming no contamination of the weighing surface (e.g., water drops on it) are given by the manufacturer as a precision error of ±0.1 g for weights less than 1,000 g and ±1.0 g for weights between 1,000 g and 10,000 g.

Unquantifiable Errors

Moss Turfs

- Changes in mass balance caused by the addition or removal of litter by natural processes (wind, runoff, decomposition, animals).
- Drainage of water during extraction of the turf for weighing (the concept of field capacity in mosses is ill-defined).
- Lack of root uptake in the turf layer (this is likely only a factor for LF turfs as there are few roots in live layers of mosses which are active in uptake).
- Lack of connection between moss turf and pit surroundings (especially significant for capillary rise, which is common in sphagnum moss turfs).

10.2 Quality Assessment
These data are preliminary. General trends in the data are reliable; however, individual measurements may be completely in error.

10.2.1 Data Validation by Source
None.

10.2.2 Confidence Level/Accuracy Judgment

Mean values of plots and gross precipitation accuracy is estimated at approximately 2 out of 5, individual measurements at 1 out of 5.

10.2.3 Measurement Error for Parameters

The time of the measurement is accurate to ± 2 hours. The measurement error of the weights of the moss turfs is given in Section 10.1. The water equivalent depth is related to these weight errors, but the precision and accuracy of the water equivalent depths are not quantified in this document.

10.2.4 Additional Quality Assessments

Data quality assessment is ongoing.

10.2.5 Data Verification by Data Center

The data were received from the HYD-08 science team and loaded into the BORIS relational data base. After loading, the data were compared with the original data files to make sure that they were loaded properly.

11. Notes

11.1 Limitations of the Data

None given.

11.2 Known Problems with the Data

Isolated data points may be in complete error because of improper recording or reformatting during documentation. Revision of data is continuing.

11.3 Usage Guidance

The moss water fluxes are conservative. Any strong jumps in time series should be flagged as potential measurement or recording errors unless explained by commensurate inputs.

11.4 Other Relevant Information

None.

12. Application of the Data Set

This data set can be used for:

- Quantifying rough canopy interception rates for given storm size at the SSA-OBS site.
- Quantifying daily moisture fluxes in moss layers.
- Possibly inferring relationships between stand parameters and measured fluxes.
- Parameterizing flux models (especially hydrological models at stand to local scale).

13. Future Modifications and Plans

Data quality assessment is ongoing by the investigators.

14. Software

14.1 Software Description
Not applicable.

14.2 Software Access
Not applicable.

15. Data Access

The HYD-08 1996 gravimetric moss moisture data are available from the Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

15.1 Contact Information
For BOREAS data and documentation please contact:

ORNL DAAC User Services
Oak Ridge National Laboratory
P.O. Box 2008 MS-6407
Oak Ridge, TN 37831-6407
Phone: (423) 241-3952
Fax: (423) 574-4665
E-mail: ornldaac@ornl.gov or ornl@eos.nasa.gov

15.2 Data Center Identification
Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics http://www-eosdis.ornl.gov/.

15.3 Procedures for Obtaining Data
Users may obtain data directly through the ORNL DAAC online search and order system [http://www-eosdis.ornl.gov/] and the anonymous FTP site [ftp://www-eosdis.ornl.gov/data/] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

15.4 Data Center Status/Plans
The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

16. Output Products and Availability

16.1 Tape Products
None.

16.2 Film Products
None.

16.3 Other Products
These data are available on the BOREAS CD-ROM series.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

None given.

17.2 Journal Articles and Study Reports

Haddeland, I. and D.P. Lettenmaier. 1995. Hydrologic Modeling of Boreal Forest Ecosystems. Water Resources Series Technical Report No. 143. University of Washington, 123 pp.

Newcomer, J., D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers, eds. 2000. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM.

Price, A.G., K. Dunham, T. Carleton, and L.E. Band. 1997. Variability of water fluxes through the Black Spruce (Picea Mariana) canopy and Feather Moss (Pleurozium Schreberi) carpet in the Boreal Forest of Northern Manitoba. Journal of Hydrology, 196, 310-323.

Sellers, P. and F. Hall. 1994. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1994-3.0, NASA BOREAS Report (EXPLAN 94).

Sellers, P. and F. Hall. 1996. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1996-2.0, NASA BOREAS Report (EXPLAN 96).

Sellers, P., F. Hall, and K.F. Huemmrich. 1996. Boreal Ecosystem-Atmosphere Study: 1994 Operations. NASA BOREAS Report (OPS DOC 94).

Sellers, P., F. Hall, and K.F. Huemmrich. 1997. Boreal Ecosystem-Atmosphere Study: 1996 Operations. NASA BOREAS Report (OPS DOC 96).

Sellers, P., F. Hall, H. Margolis, B. Kelly, D. Baldocchi, G. den Hartog, J. Cihlar, M.G. Ryan, B. Goodison, P. Crill, K.J. Ranson, D. Lettenmaier, and D.E. Wickland. 1995. The boreal ecosystem-atmosphere study (BOREAS): an overview and early results from the 1994 field year. Bulletin of the American Meteorological Society. 76(9):1549-1577.

Sellers, P.J., F.G. Hall, R.D. Kelly, A. Black, D. Baldocchi, J. Berry, M. Ryan, K.J. Ranson, P.M. Crill, D.P. Lettenmaier, H. Margolis, J. Cihlar, J. Newcomer, D. Fitzjarrald, P.G. Jarvis, S.T. Gower, D. Halliwell, D. Williams, B. Goodison, D.E. Wickland, and F.E. Guertin. 1997. BOREAS in 1997: Experiment Overview, Scientific Results and Future Directions. Journal of Geophysical Research 102(D24): 28,731-28,770.

17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None given.

19. List of Acronyms

ASCII - American Standard Code for Information Interchange
BOREAS - BOReal Ecosystem-Atmosphere Study
BORIS - BOREAS Information System
CD-ROM - Compact Disk-Read-Only Memory
DAAC - Distributed Active Archive Center
EOS - Earth Observing System
EOSDIS - EOS Data and Information System
FFC-T - Focused Field Campaign - Thaw
GIS - Geographic Information System
GMT - Greenwich Mean Time
GSFC - Goddard Space Flight Center
HTML - Hyper-Text Markup Language
HYD - Hydrology
IFC - Intensive Field Campaign
NAD83 - North American Datum of 1983
NASA - National Aeronautics and Space Administration
NSA - Northern Study Area
OBS - Old Black Spruce
ORNL - Oak Ridge National Laboratory
PANP - Prince Albert National Park
SSA - Southern Study Area
URL - Uniform Resource Locator

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13. ABSTRACT *(Maximum 200 words)*

The BOREAS HYD-8 team made measurements of surface hydrological processes that were collected at the SSA-OBS Tower Flux site in 1996 to support its research into point hydrological processes and the spatial variation of these processes. Data collected may be useful in characterizing canopy interception, drip, throughfall, moss interception, drainage, evaporation, and capacity during the growing season at daily temporal resolution. This particular data set contains the gravimetric moss moisture measurements from July to August 1996. To collect these data, a nested spatial sampling plan was implemented to support research into spatial variations of the measured hydrological processes and ultimately the impact of these variations on modeled carbon and water budgets. These data are stored in ASCII text files.

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